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Mapping the Afloat Medical Materiel Supply Chain: Procurement and Transshipment in the U.S. Navy

December 2025

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ABSTRACT

This study examined factors contributing to extended lead times in the U.S. Navy's Class VIII(a) medical materiel supply chain and identified opportunities to improve logistics responsiveness for afloat units operating under Pacific Fleet (PACFLT). A comprehensive process map was developed using qualitative data from stakeholder interviews, direct observations during a site visit to Defense Distribution Norfolk, Virginia (DDNV), and document review. Quantitative data were analyzed to assess transshipment throughput, backlog behavior, capacity utilization, and the effects of demand variability. Comparative analysis showed that electronic catalogue (ECAT) ordering reduced procurement lead times by an average of 53.5 days relative to Military Standard Requisitioning and Issue Procedures (MILSTRIP), accounting for up to 72 percent of total supply chain duration for CONUS units and 65 percent for OCONUS units. Modeling indicated that increasing staffing to 10 processor full-time equivalents would reduce average processing time from 7 to 1.7 days, decreasing backlog and overtime. Conversely, establishing a second transshipment center would increase total backlog, reduce efficiency, and raise manpower costs. Findings suggest that aligning authorized medical allowance list (AMAL) assemblages with e-commerce contracting would increase transshipment capacity, and defining fleet performance standards would improve Class VIII(a) logistics readiness.

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TABLE OF CONTENTS

LIST OF FIGURES

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LIST OF TABLES

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LIST OF ACRONYMS AND ABBREVIATIONS

AIRPAC	Naval Air Forces Pacific
AMAL	authorized medical allowance list
AOR	area of responsibility
CAA	Contingency Automation Application
CLASS VIII(a)	Medical Materiel and Equipment
CRIF	cargo routing information file
DDNV	DLA Distribution Norfolk, Virginia
DEA	Drug Enforcement Agency
DLA	Defense Logistics Agency
DMO	Distributed Maritime Operations
DSS	Distribution Standard System
DVD	Direct Vendor Delivery
EBS	Enterprise Business System
ECAT	electronic catalog
FIFO	first in first out
FTE	full-time equivalent
MILSTRIP	Military Standard Requisitioning and Issue Procedures
NMRLC	Naval Medical Readiness Logistics Command
NSN	national stock number
PACFLT	U.S. Pacific Fleet
PVWO	Prime Vendor Web Ordering
R-Supply	Relational Supply
SDR	Supply Discrepancy Report
SURFPAC	Naval Surface Forces Pacific
TLAMM	Theater Lead Agent for Medical Materiel
WMS	Warehouse Management System

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I. INTRODUCTION

The lifeline of every deployed U.S. Navy ship is its ability to receive the medical materiel needed to protect the health and fighting strength of its crew. Yet, across the Pacific Fleet (PACFLT), ships routinely face long and unpredictable delays in receiving essential Class VIII(a) medical supplies, delays that have direct consequences for operational readiness. As the National Military Strategy warns, the United States must sustain combat-credible forces capable of prevailing against the People's Republic of China in the Indo-Pacific, a requirement that hinges not only on warfighting platforms but also on the resilience and responsiveness of the medical systems that support them (Secretary of Defense, 2022).

Currently, the end-to-end medical supply chain is fragmented across multiple organizations, each exercising authority over discrete segments of the requisition, distribution, and delivery continuum. This structural separation introduces complexity and contributes to inefficiencies that impact the timeliness and predictability of medical materiel delivery to deployed platforms.

This research seeks to uncover why these delays persist and what can be done to eliminate them. To illuminate the complexities of this global logistics network, a comprehensive end-to-end process map was constructed to trace every stage of Class VIII(a) medical materiel movement, from the moment an afloat unit initiates an order to its final receipt. By clarifying lanes of ownership, stakeholder responsibilities, and procedural interactions, this process map provides a critical foundation for identifying inefficiencies, organizational seams, and opportunities to accelerate performance. This study provides data-driven insights and actionable strategies to strengthen the Navy's medical supply chain and to enhance the readiness of U.S. operational forces across the Pacific.

This research systematically identified the sequence of activities, key stakeholders, and decision points that comprise the afloat medical logistics process and evaluated their collective performance in meeting operational and medical readiness requirements. The resulting process map provides a foundation for evaluating process bottlenecks, redundancies, and performance gaps, offering an evidence-based framework for identifying opportunities to improve coordination, streamline materiel flow, and enhance supply-chain responsiveness. Ultimately, the findings of this study aim to inform policy, infrastructure, and procedural improvements that will strengthen both current and future Navy afloat medical logistics capabilities in support of distributed maritime operations.

A. PROBLEM STATEMENT

The U.S. Navy surface fleet is composed of ships with diverse mission sets and operational requirements, each possessing medical departments of varying size and capability tailored to their assigned missions. Given the constrained storage capacity inherent to afloat platforms, the reliability and predictability of medical resupply infrastructure are essential for sustaining medical readiness and preventing stockouts that could degrade onboard healthcare delivery.

Authorized medical allowance list (AMAL) inventories are structured to provide approximately 60 days of supply, creating a dependence on the Navy's medical logistics and resupply systems to replenish consumables and equipment in a timely and consistent manner (Naval Medical Logistics Command, 2016). Medical personnel reliance on these systems directly affects their capacity to maintain continuous operational readiness and deliver medical care throughout sustained deployments.

Delays or inconsistencies across the medical logistics process can reduce a unit's ability to deploy on short notice and sustain operations at full capability (R. Flores, personal interview, May 2, 2025). Furthermore, inefficiencies in the current supply chain place additional strain on the in-theater logistics capabilities during periods of heightened operational demand or contingency response. This research is motivated by observed variability in medical materiel delivery duration across the fleet, which has contributed to uneven levels of materiel readiness among afloat medical departments. Understanding and addressing supply chain issues that impact consistent performance is therefore critical to enhancing the resilience, responsiveness, and overall performance of the Navy's afloat medical logistics system.

B. REASEARCH QUESTIONS

This project seeks to answer the following key research questions:

1. What process, policy, or infrastructure changes could further improve afloat medical logistics and reduce order to receipt variability?
2. How well does the current medical materiel procurement and delivery process meet afloat units' need for timeliness and reliability?
3. Where in the transshipment process do decision gates, handoffs, or ownership transitions create the most variability in order-to-receipt timelines?
4. How might establishing a secondary transshipment hub affect supply chain performance compared to the current single-hub model?

C. METHODOLOGY

To examine the end-to-end medical supply requisition process and construct a comprehensive process flow map, this study employed a qualitative research approach that integrated interviews, site observations, and document analysis.

Interviews were conducted with key medical logistics leaders and subject-matter experts across multiple echelons, including U.S. Pacific Fleet, Commander, Naval Surface Forces Pacific, Commander, Naval Air Forces Pacific, and the Defense Logistics Agency (DLA) Troop Support. These discussions provided insights into policy implementation, operational challenges, and inter-organizational coordination within the afloat medical supply chain.

A site visit was conducted at DLA Distribution Norfolk, Virginia (DDNV) to observe firsthand the workflows, materiel handling procedures, and decision points associated with the transshipment process. Observations and interviews during this visit facilitated a detailed understanding of how afloat units receive, process and forward medical materiels.

Supplementary data were obtained through a review of relevant Navy publications, procedural manuals, and governing instructions, which served to contextualize the observed practices within existing policy frameworks. Collectively, these methods enabled a holistic mapping of the medical supply requisition process from order initiation to final receipt, forming the foundation for subsequent analysis and process improvement recommendations.

D. LIMITATIONS AND SCOPE

Afloat units are required to procure medical materiel and equipment, collectively categorized as Class VIII(a) through established channels including the Military Standard Requisitioning and Issue Procedures (MILSTRIP), electronic catalog (ECAT), Government Commercial Purchase Card, Prime Vendor Web Ordering (PVWO), and Theater Lead Agent for Medical Materiel (TLAMM, a geographic area lead to assist with medical materiel procurement while operating in the assigned geographic region) (Department of the Navy, 2024). Each of these procurement mechanisms operates under distinct policy constraints and geographic limitations that affect their applicability to afloat operations.

The availability and effectiveness of these procurement methods are influenced by both a unit's current and projected operating locations. PVWO is restricted to use while the ship is in its home port, whereas TLAMM support is constrained to specific areas of responsibility (AORs) under the 5th, 6th, or 7th Fleet (Department of the Navy, 2024). Because TLAMMs provide region-specific medical supply support, their utility diminishes during transits between AORs or when operating outside the geographic scope of an assigned TLAMM, thereby reducing procurement flexibility.

For these reasons, this study examines only MILSTRIP and ECAT processes. These two systems provide the most consistent procurement mechanisms for afloat medical units across the full operational cycle, regardless of geographic location. Their reliance on a transshipment warehouse to receive, consolidate, and forward medical materiel to deployed units makes them particularly relevant for understanding the timeliness, reliability, and efficiency of medical logistics in support of mobile naval operations.

II. BACKGROUND

A. OVERVIEW OF AFLOAT MEDICAL SUPPLY CHAIN

The Class VIII(a) medical supply chain supporting U.S. Navy afloat units is a complex, globally distributed system with multiple installations, systems, stakeholders, process owners, decision points, and other assets that must operate in concert to ensure the timely delivery of medical materiel and prevent disruptions to shipboard medical readiness. This network spans various organizational levels and geographic regions, integrating the efforts of logistics centers, supply commands, and medical departments to move critical materiel from point of origin to the end user around the globe in port or at sea.

Each participating entity performs a distinct yet interdependent role within this system, from requisition initiation and materiel sourcing to consolidation, transshipment, and final delivery. The efficiency and reliability of the entire system are contingent upon the synchronization and timeliness of actions taken within each segment of the process. Maintaining an efficient flow of Class VIII(a) materiel requires not only procedural precision but also effective coordination among all organizations involved in the afloat medical logistics enterprise.

1. Class VIII(a) Order Management

The management of Class VIII(a) medical materiel aboard U.S. Navy ships is governed by the policy framework established in OPNAV Instruction 4406.2, which standardizes procedures for the procurement, storage, and inventory management of medical and dental supplies. The instruction directs all Navy afloat activities that procure, track, and maintain Class VIII(a) materiel to meet defined readiness benchmarks through the maintenance of AMALs and Authorized Dental Allowance Lists (ADALs). These clinically driven assemblages prescribe the minimum quantities of consumables, pharmaceuticals, and equipment necessary to sustain a ship's medical capability in accordance with its Required Operational Capabilities and Projected Operating Environment.

To maintain high levels of supply readiness and medical mission capability, OPNAVINST 4406.2 establishes specific performance standards for afloat units: 90 percent on-hand materiel readiness and 100 percent on-order status for non-emergency AMALs and ADALs, and 100 percent on-hand or on-order levels for emergency AMALs and ADALs. Non-emergency AMALs support preventive, routine, and non-emergent medical care aligned with the ship's operational profile, while emergency AMALs contain trauma supplies pre-positioned to support immediate casualty treatment and damage-control operations. Collectively, these readiness standards serve as both a logistical benchmark and a management framework, guiding shipboard medical personnel in prioritizing procurement actions, conducting inventory audits, and coordinating resupply activities that directly support operational readiness.

While these standards define the ideal state of materiel availability, maintaining them during deployment presents substantial challenges. Afloat medical departments must balance anticipated usage, operational tempo, supply lead times within diverse and often unpredictable environments, and storage restrictions. The Operational Medical Logistics in Distributed Maritime Operations (DMO) study found that current shipboard inventories are insufficient to meet the demands of a high-intensity maritime conflict in which multiple ships sustain casualties simultaneously (Johns Hopkins University Applied Physics Laboratory [JHU/APL], 2019). In such scenarios, the rapid increase in Class VIII(a) materiel consumption would quickly exceed authorized allowance levels, necessitating either substantially larger onboard inventories or the ability to conduct high-volume, rapid resupply operations (JHU/APL, 2019).

2. Class VIII(a) Procurement

The procurement of Class VIII(a) medical materiel within the U.S. Navy supply chain is primarily executed through the DLA Troop Support, which manages both manual acquisition processes and automated e-commerce procurement systems to fulfill medical supply requirements across the fleet (M. Jones, personal communication, April 9, 2025). This dual strategy is designed to balance efficiency, responsiveness, and cost-effectiveness in meeting the diverse and dynamic needs of afloat medical units.

Through DLA's integrated procurement framework, materiel acquisition is conducted either via traditional contracting mechanisms under the MILSTRIP or through web-based ordering platforms, such as the ECAT system. The e-commerce model streamlines sourcing and order fulfillment by directly connecting requisitions to pre-approved vendors operating under established contractual agreements (T. Revak, personal communication April 9, 2025). This process enables direct vendor delivery to the designated transshipment center, DDNV, effectively bypassing the need for extensive government warehousing or stockpiling of most Class VIII(a) items.

By minimizing on-hand inventories and leveraging vendor-managed supply mechanisms, DLA Troop Support's procurement approach reduces overhead costs while maintaining flexibility to meet routine and emergent medical requirements. This system reflects a strategic shift from traditional bulk storage logistics toward a just-in-time, demand-responsive model optimized for the Navy's globally distributed and highly mobile operating environment.

3. Transshipment and Unit Delivery

The transshipment process serves as a critical intermediary function within the Class VIII(a) medical supply chain, enabling vendors to deliver materiels to a designated, fixed location for subsequent processing and redistribution to afloat units. This mechanism is essential for ensuring consistent materiel throughput and accurate receipt due to the inherently mobile and geographically dispersed nature of naval platforms. Without an established transshipment capability, dynamically redirecting shipments to align with a vessel's changing operational location would be logistically complex, resulting in increased volumes of frustrated cargo, extended supply-chain latency (time delay between demand signal and when the demand is fulfilled), and reduced overall materiel readiness.

The DDNV facility functions as the Navy's primary Class VIII(a) transshipment center, receiving medical materiel from commercial vendors and coordinating subsequent delivery to afloat units. Using each ship's Cargo Routing Information File (CRIF), DDNV ensures that shipments are accurately routed to the unit's current or projected operating area (M. Lassiter, personal communication, September 17, 2025). This process enables global delivery continuity, allowing afloat units to receive medical supplies regardless of their deployment location or movement status.

Transshipment operations leverage commercial transportation networks to minimize delivery times and enhance efficiency. Upon arrival at regional hubs or local consolidation centers, shipments are processed by DLA or Navy distribution personnel who execute the final stage of delivery, often referred to as "last-mile delivery." This phase includes both pier-side transfer for ships in port and underway replenishment (UNREP) for units at sea.

B. ADDITIONAL SUPPLY CHAIN IMPLICATIONS

Distributed or contested environments may force afloat units to retain casualties for extended durations due to distance from higher echelons of care, degraded communications, or loss of air superiority, thereby further increasing Class VIII(a) consumption rates (JHU/APL, 2019). The DMO study concluded that the existing Navy medical-logistics model characterized by long and unpredictable lead times would be insufficient under wartime conditions highlighting the need to improve the current Class VIII(a) supply chain velocity to meet anticipated wartime needs. It recommended exploring a shift from a predominantly pull-based supply system, where units requisition materiel as needed, to a push-based model that proactively positions medical materiel forward based on predicted demand and casualty projections. Such an approach would enable rapid surge capacity, adaptive sourcing, and improved responsiveness across distributed maritime operations (JHU/APL, 2019).

Complementary research reinforces these findings by emphasizing the need for greater supply-chain flexibility and responsiveness. Williams (2020) examined innovative solutions to persistent Class VIII(a) logistics challenges and proposed additive manufacturing (3D printing) as a potential means to offset long resupply lead times in deployed environments. Forward-deployed 3D-printing capabilities could enable on-demand production of select medical consumables, reducing dependence on lengthy supply chains and improving readiness in contingency conditions (Williams, 2020). This approach directly would address forecasting uncertainty, transport latency, and inventory inflexibility persistent pain points within the current system.

As Williams (2020) noted, the traditional Navy medical-supply model is inherently reactive and cannot dynamically scale throughput to meet sudden surges in medical demand. Distributed additive-manufacturing technologies, by contrast, could provide point-of-need production capacity in support of contingency or high-tempo operations. While 3D printing is not a universal solution, its integration into future operational logistics architectures could meaningfully reduce supply-chain vulnerability, enhance resilience, and sustain medical readiness under distributed or contested conditions.

Taken together, the literature underscores that maintaining Class VIII(a) medical materiel readiness aboard afloat units requires a modernized and adaptive logistics framework capable of reconciling established policy standards with the operational realities of dynamic maritime environments. Addressing sources of supply-chain latency and identifying systemic areas for improvement are essential steps toward overcoming current logistical constraints and ensuring the medical supply system can scale effectively to meet wartime demands. Achieving this alignment will depend on the ability of key stakeholders to collaboratively strengthen performance standards, enhance integration between assemblage management and procurement systems, and expand logistical capacity generation to support sustained medical readiness across all phases of naval operations.

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III. METHODOLOGY

This chapter outlines the research design, data collection methods, analytical techniques, and comparative assessment procedures employed to examine the end-to-end Class VIII(a) medical logistics process supporting U.S. Navy afloat units. The methodology was designed to establish a systematic and comprehensive framework for understanding how medical materiel is ordered, sourced, transported, and received within a globally distributed and operationally dynamic supply network. By integrating multiple qualitative and analytical approaches, this research aims to capture both the structural and procedural dimensions of afloat medical logistics performance, identify sources of process inefficiency, and inform opportunities for improvement that enhance fleet medical readiness and supply-chain responsiveness.

A. DESIGN

This study employed a qualitative embedded case study design to investigate the U.S. Navy's afloat medical supply chain, with a specific focus on the processes managed through the DLA Troop Support and DDNV. The embedded case study approach was selected because it enables detailed exploration of interrelated systems and processes within a real-world operational context. This approach is particularly appropriate for analyzing supply chains that span multiple organizations, functional authorities, and geographic regions.

The research design integrates three methods: process mapping, document analysis, semi-structured interviews, and quantitative analysis to generate a complete picture of the end-to-end afloat medical logistics system. The combination of these methods allows for validation across data sources, enhancing the reliability of findings.

The study focuses on the two procurement pathways most relevant to afloat medical units: the MILSTRIP and the ECAT systems. Both serve as primary ordering mechanisms for afloat units throughout their operational cycle. The research design aims to trace orders through each stage of the Class VIII(a) supply chain from order origination at the unit level through acquisition, vendor fulfillment, transshipment, commercial transportation, and final receipt aboard ship to identify process bottlenecks, inefficiencies, and opportunities for improvement.

B. DATA COLLECTION

Data collection was conducted through three primary methods: semi-structured interviews, direct observation, and document review.

1. Interviews

Semi-structured interviews were conducted with key stakeholders and subject-matter experts representing multiple organizations within the naval medical logistics enterprise. PACFLT Medical provided and coordinated access to points of contact facilitating engagement with personnel in U.S. Pacific Fleet, Naval Surface Forces Pacific (SURFPAC), Naval Air Forces Pacific (AIRPAC), the DLA Troop Support, DDNV, and the Naval Medical Readiness Logistics Command (NMRLC).

A combination of telephone interviews and email correspondence was used to accommodate participant availability and geographic dispersion. Discussions were structured to elicit detailed insights regarding organizational roles, procurement policies, operational constraints, process performance, and perceptions of overall supply-chain effectiveness. The semi-structured interview format enabled a balance between consistency across participants and flexibility to explore emergent topics of particular relevance to each stakeholder's area of expertise.

Interview data revealed key thematic areas including order processing timelines, transshipment coordination, and the impact of supply-chain performance on fleet medical readiness. In addition to verbal data, several interviewees provided internal training materiels, white papers, and process documentation that clarified data-system interactions and internal workflows. These materiels, along with participant insights, contributed directly to the development of the end-to-end process flow map depicting Class VIII(a) medical materiel movement from requisition to delivery.

Interviewees:

- Master Chief Ricardo Flores, Fleet Health Services, PACFLT: Email correspondence April 9- October 28, 2025, Telephone/Teams interviews May 2 and August 14, 2025
- Master Chief Noel Matrinez, Fleet Health Services, SURFPAC: Phone interviews April 17, August 15, and August 25, 2025
- Master Chief Randall Connolly, Medical Master Chief, AIRPAC: Phone interview October 10, 2025
- Master Chief Angel Delgado, Logistics Specialist: Test correspondence November 1, 2025
- Senior Chief Justin Cayetano, Medical Readiness Division, SURFPAC: Text correspondence October 3, 2025
- Michael Bahe, Fleet Health Services, PACFLT: Email correspondence May 2 August 24, 2025, phone interviews May 2 and July 24, 2025
- Carlos Lopez, Deputy Director, NMRLC: Email correspondence May 28 August 18, 2025, Teams meeting July 29, 2025
- Lieutenant Commander Megan Jones, DLA Troop Support: Email correspondence April 3 October 28, 2025, Phone/Teams interview April 9, and August 5, 2025
- Thomas Revak, DLA Troop Support: Email correspondence August 20 – September 26, 2025, Phone interview August 25, 2025
- Monica Lassiter, DDNV: Email correspondence June 12 – September 29, 2025, Site visit September 16–17, 2025
- Materiel processors, DDNV: Site visit September 16–17, 2025
- Hospital Corpsman 1st Class Katlyn Schrecengost, Assemblage Manager, NMRLC: Phone interview October 29, 2025

2. Site Visit and Observation

A field visit was conducted from 16–17 September 2025 at DDNV, the Navy's primary medical transshipment hub for afloat Class VIII(a) materiel. During this visit, direct observations were made of materiel-handling workflows, storage procedures, and order-processing operations. These observations provided a detailed understanding of DDNV's operational processes, including receipt, segregation, documentation, and outbound distribution of medical materiel.

Informal interviews with warehouse personnel supplemented these observations, offering contextual insights into the daily execution of transshipment activities and the handling requirements for cold-chain, controlled substance, and HAZMAT shipments. Observational data were systematically recorded through field notes, photographs, and process sketches, which were subsequently synthesized and incorporated into the end-to-end process flow map developed for this study.

In addition to qualitative observations, DDNV personnel provided quantitative performance data documenting daily operational throughput and backlog status from 28 May 2013 through 29 September 2025. These data captured the number of orders received and processed each day, both in aggregate and by category cold-chain, controlled substances, HAZMAT, and general medical. The dataset, maintained locally in Microsoft Excel by entering daily receipts and productivity by hand at the end of the production day, served as a continuous performance log used by DDNV management to monitor daily productivity and assess materiel backlog trends.

3. Document and Publication Review

Additional information was obtained through a systematic review of relevant Navy and DLA publications, including logistics manuals, procedural instructions, and policy directives. These documents, listed below, provided the formal context for understanding supply chain governance, system interfaces, and compliance requirements:

- DLA Medical CAA Trap Explainer (Defense Logistics Agency Troop Support, PowerPoint slides, October 25, 2024)

- Class VIII Support for Navy Operational Medicine at Sea (R. Owens, PowerPoint slides, July 23, 2024)
- Talking paper: The critical importance of National Stock Number Maintenance to DoD Medical Supply Chain Support (M. Jones, personal communication, April 9, 2025)
- DLA Customer Handbook (Defense Logistics Agency, 2023)
- OPNAVINST 4406.2 Shipboard Supply Procedures for Class VIII Medical Materiels (Office of the Chief of Naval Operations, 2024)
- DLA Troop Support Memo: All Suppliers Receiving Orders for Medical Materiel for Overseas Shipment June 2nd, 2025 (Keefe, 2025)

C. DATA ANALYSIS

Data analysis followed a structured, multi-phase process designed to convert raw qualitative data into actionable insights integrated with quantitative data analysis.

1. Phase I: Process Mapping

Field observations, interview transcripts, and document data were evaluated to construct a comprehensive end-to-end process flow map depicting each major node and stakeholder within the afloat medical logistics system. Each stage was analyzed to identify decision points, dependencies, and potential sources of delay or uncertainty.

2. Phase II: Quantitative Data Analysis

Historical real-time operational data collected and maintained by DDNV were analyzed to evaluate the processing efficiency and capacity of the medical transshipment center. The dataset, as received, included daily order receipts, counts of orders processed, counts of orders awaiting processing, end-of-day backlog totals, and categorization of processed items across five classes (controlled substances, cold-chain, HAZMAT, general medical local, and general medical non-local).

Using these source data fields, several performance metrics were calculated to assess operational throughput and variability. These derived measures included the daily number of days required to clear backlog, average daily backlog, average days to clear backlog, processor-level production rates, overall workforce capacity utilization, and maximum observed backlog clearance times. Together, these metrics provided an empirical foundation for evaluating workflow efficiency and identifying structural constraints within transshipment operations.

Daily receipt data were used to estimate average daily demand for materiel processing, establishing baseline throughput requirements. Backlog data were analyzed to determine both maximum and average volumes of materiel awaiting processing, serving as indicators of system responsiveness. The frequency of weekend processing events despite DDNV's normal Monday–Friday operating schedule was also assessed. These occurrences were interpreted as surge-capacity actions implemented to offset accumulated backlog and maintain acceptable levels of operational performance.

3. Phase III: Comparison Analysis

A comparative assessment was conducted to evaluate the relative performance characteristics of the two primary procurement pathways MILSTRIP and ECAT and to assess the potential benefits of proposed improvements to the Class VIII(a) supply process. An order-to-delivery timeline with duration was developed to illustrate end-to-end system performance, incorporating benchmark performance provided by DLA Troop Support and real-world operational data supplied by DDNV. Benchmark performance data were applied where available from process owners, while mean and maximum transshipment processing times for DDNV were derived from historical records. These comparative timelines were then used to assess the influence of procurement method and transshipment variability on overall supply chain performance.

(1) Step 1: Afloat Unit Order Placement

Order initiation aboard the afloat unit was treated as Day 0. Delays associated with internal identification of requirements or onboard approval workflows were not included in the modeled duration, as the analysis focused on supply chain performance external to the ship.

(2) Step 2: Procurement Processing Benchmarks

DLA Troop Support benchmarks—formal performance standards that the organization is obligated to meet—were used to represent procurement processing durations. ECAT orders were assigned a benchmark of 1.5 days, while MILSTRIP orders that could not be converted through the Contingency Automation Application (CAA) trap were assigned a benchmark of 30 days for manual procurement (M. Lassiter, personal communication, September 17, 2025).

(3) Step 3: Vendor Fulfillment Benchmarks

Vendor delivery times, also provided by DLA Troop Support, were incorporated into the model. ECAT orders were assigned a 5-day vendor delivery benchmark, whereas MILSTRIP orders for consumable items were assigned 30 days, reflecting the longer times associated with manual sourcing. Procurement method and vendor fulfillment times are directly interconnected and were treated as (Defense Logistics Agency Troop Support, PowerPoint slides, October 25, 2024).

(4) Step 4: DDNV Transshipment Performance

DDNV did not maintain formal performance benchmarks for Class VIII(a) transshipment; however, the activity provided daily processing records that enabled empirical assessment of operational performance. The period from 1 January 2023 through 29 September 2025 was used to calculate the actual number of days required to clear backlog. This timeframe was intentionally selected to avoid the inclusion of COVID-related procurement irregularities that could distort baseline performance. Because DDNV employed a first-in, first-out (FIFO) priority processing, backlog duration served as a direct and reliable measure of transshipment processing time (M. Lassiter, personal communication, September 17, 2025). The end-to-end model latency was calculated using both average and maximum transshipment durations to capture the effects of operational variability on overall system performance.

(5) Step 5: Commercial Transportation Times

Commercial shipping times differ for CONUS and OCONUS destinations. For this analysis, 3 days was used as the CONUS shipping duration. For OCONUS shipments particularly relevant for PACFLT units a value of 11 days was used, representing 5–7 days of transportation plus up to 4 days for customs clearance.

(6) Step 6: Last-Mile Delivery

Last-mile delivery may occur either via pier-side delivery or transfer to a Military Sealift Command vessel for underway replenishment (UNREP). Due to the dynamic nature of ship schedules and the operational prioritization of UNREP assets, the model applies a standardized 4-day duration for pier-side delivery to represent last-mile processes (A. Delgado, personal communication, November 1, 2025).

(7) Step 7: Unit Receipt

The final step, unit receipt and internal distribution, is acknowledged but assigned no additional time value for modeling purposes.

This three-phase methodological approach integrating qualitative insights from stakeholder interviews and field observations with quantitative performance data offered a structured and comprehensive framework for interpreting the Class VIII(a) medical logistics system. By linking real-world operational experiences with measurable supply-chain performance indicators, the study enabled a holistic assessment of system effectiveness and the identification of critical factors influencing end-to-end medical materiel flow.

D. TRANSSHIPMENT MODEL ASSESSMENT

To further evaluate transshipment performance, a simulation model was developed using daily processing capacities derived from operational data presented earlier in this chapter. The model accounted for the functional distribution of processors by assigning one processor each to HAZMAT and cold-chain handling requirements. Because processing frequency for controlled substances was comparatively low, no reduction in processing capacity was applied for this category. Based on these workload deductions, and assuming an equivalent of seven processors per day, the maximum daily processing capacity at full utilization was 240 orders per day.

The model incorporated the following parameters, with the backlog level on 1 January 2023 serving as the initial condition:

1. Baseline Utilization: The system operates at 85% capacity unless the backlog exceeds three days.
2. Increased Utilization: If backlog exceeds three days, utilization increases to 100%.
3. Overtime Surge Capacity: If the backlog exceeds five days and over 1,000 packages in backlog, production is increased by a multiplier of 1.5 to approximate overtime and surge operations.
4. Non-Negative Backlog Constraint: Backlog values were constrained to prevent negative values.
5. No-Receipt Days: Days with zero receipts (weekends and holidays) were assigned zero production, consistent with observed operational behavior.
6. Dynamic Backlog Calculation: Backlog for each day was computed by adding daily receipts to the previous day's backlog and subtracting daily processing output.

Actual daily receipt quantities from the evaluation period were used as inputs, allowing the model to reflect realistic demand variability and operational constraints.

$$B_0 = 2186$$

$$B_t = \max\{\, B_{t-1} + R_t - \alpha C_t,\ 0\,\}$$

$$\alpha = \begin{cases} 0.85, & B_t < 1000 \\ 1.0, & B_t \geq 1000 \text{ and } 3 < D_{t-1} < 5 \\ 1.5, & B_t > 1000 \text{ and } D_{t-1} > 5 \end{cases}$$

$$D_t = \frac{B_t}{\alpha C_t}$$

$$M_t = \min(B_{t-1} + R_t,\ \alpha C_t)$$

$$U_t = \frac{M_t}{\alpha C_t}$$

$$C_t = 40\,(FTE_{t-1})$$

Notation:

t = time index

B_t = daily backlog

R_t = daily receipts

C_t = daily nominal capacity

α = Production multiplier

D_t = Days to clear backlog

M_t = Daily production

U_t = Daily utilization

FTE_t = Daily full time equivalent

The study also evaluated the performance of the current single-hub transshipment model by simulating system behavior under a fixed daily processing capacity of 240 orders, with incremental changes of one additional processor (equivalent to 40 general medical orders per day). This approach was used to determine the number of processors required for the system to operate at or around 85% utilization. These additional daily production values were run through the model to determine the number of calendar days with a backlog, average daily backlog, maximum order backlog observed, maximum backlog days observed, the 80% service level, number of overtime days needed to meet production demands, the number of days that utilization was 95% or greater, and number of days utilization fell below 70%, i.e. $M =_t$:

- 280 (8 processor full-time equivalent (FTE))
- 320 (9 processor FTEs)
- 360 (10 processor FTEs)
- 400 (11 processor FTEs)

To assess the potential value of establishing a supplemental West Coast transshipment site, the initial backlog and daily receipt volumes were divided evenly, reflecting the approximate distribution of afloat units that would be serviced by each coast's distribution facility. Daily processing numbers were adjusted to reflect staffing production based on the current DDNV staffing model. The following daily production values were run through the model to demonstrate the production of each facility (one on the East coast and one on the West Coast):

- 240 (7 processor FTEs, 11 total staff)
- 200 (6 processor FTEs, 10 total staff)
- 160 (5 processor FTEs, 9 total staff)
- 120 (4 processor FTEs, 8 total staff)

Process-flow data, commercial shipment times, and stakeholder input were integrated to evaluate whether a secondary transshipment node could reduce lead times and improve supply responsiveness for Pacific Fleet units operating at significant distances from the East Coast. The comparative framework considered multiple performance dimensions including order timeliness, transshipment throughput capacity, cost implications (limited to cost of manpower, facility cost and other infrastructure items were not included), and operational risk to assess the feasibility and expected benefits of a dual-hub transshipment model.

The findings from this comparative assessment informed the development of recommendations for improving the efficiency, resilience, and responsiveness of the afloat medical supply chain, particularly as it pertains to supporting globally disbursed afloat units.

IV. RESULTS AND ANALYSIS

A. RESULTS AND ANALYSIS

1. Class VIII(a) Process Map

The development of the Class VIII(a) supply chain process map identified seven primary stages within the afloat medical materiel pipeline:

1. Afloat unit order origination
2. DLA Troop Support acquisition
3. Vendor fulfillment
4. DDNV transshipment operations
5. Commercial carrier transport
6. Last-mile delivery (via DLA Distribution centers or Military Sealift Command supply vessels)
7. Afloat unit receipt

Each of these stages performs an essential function within the end-to-end Class VIII(a) supply chain and collectively determines the overall responsiveness and reliability of medical materiel delivery to afloat units. Figure 1 provides a graphical representation of this complete process flow, illustrating the sequence of activities and the interdependencies among stakeholders.

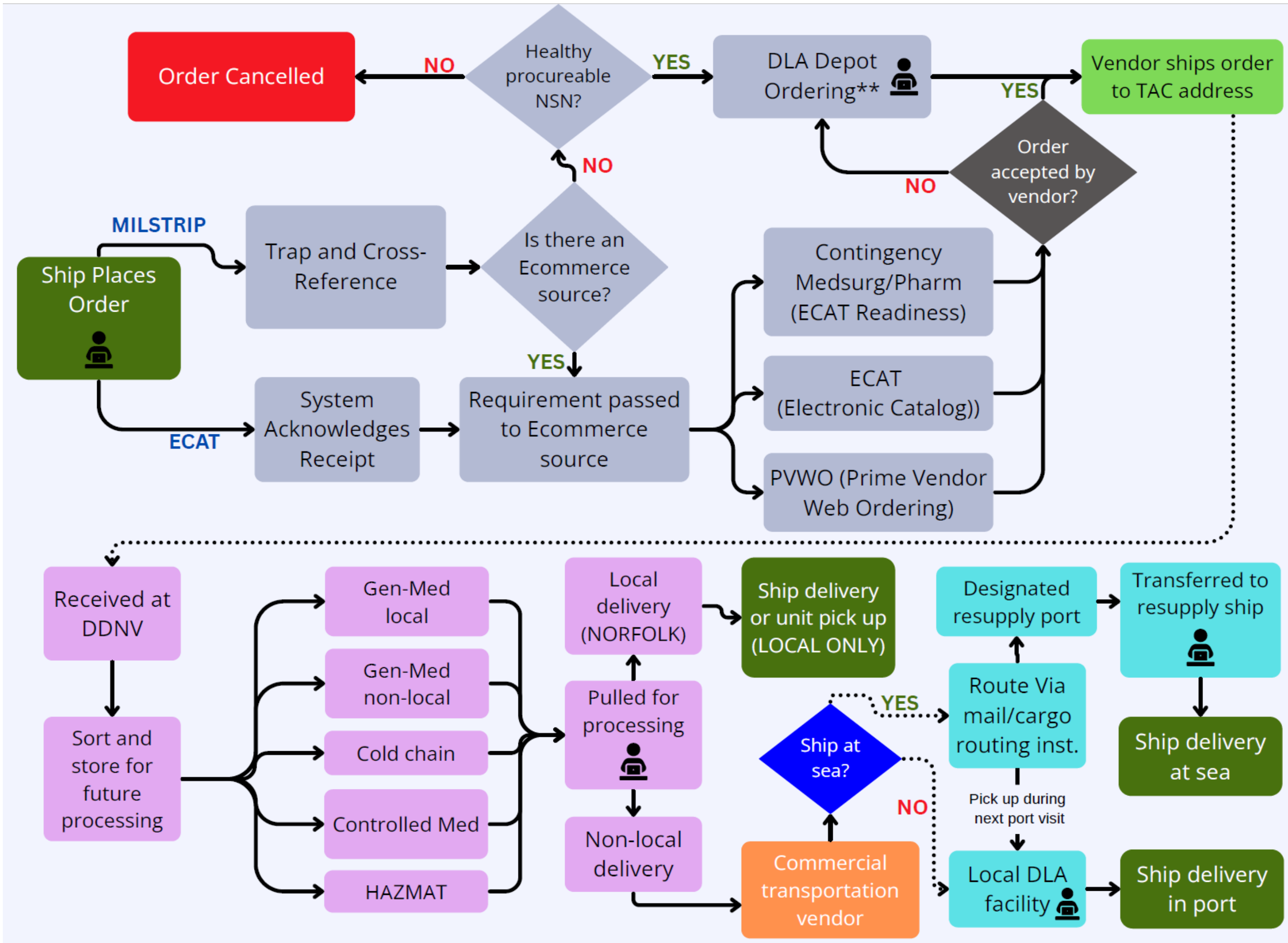

Figure 1. Class VIII(a) ECAT and MILSTRIP Process Flow

a. Afloat Unit Order Origination

The afloat unit medical department serves as the point of origin for the Class VIII(a) medical supply chain. It is at this level that requisitions are initiated through either the ECAT system or Relational Supply (R-SUPPLY) (both systems described in more detail below), formally triggering downstream logistics actions within the broader medical supply network. While the act of order submission begins the formal supply chain sequence, the preliminary internal processes and decision-making within the medical department are equally critical, as they directly influence the unit's materiel readiness and the timeliness of replenishment (N. Martinez, personal communication, August 15, 2025).

Orders for medical materiel or equipment are typically generated under three primary circumstances:

- When new requirements emerge, it is often due to AMAL revisions that introduce new mandatory items.
- When existing materiel becomes unserviceable, whether due to damage, degradation, or expiration, necessitating replacement to maintain compliance and functionality.
- When operational tempo drives consumption of onboard inventories, creating the need for replenishment to sustain medical readiness.

Across the surface fleet, the training, experience, and procedural rigor of personnel managing Class VIII(a) materiel vary considerably. There is no standardized training pipeline to establish a uniform knowledge-base among Sailors responsible for afloat medical logistics functions (R. Flores, personal communication, May 2, 2025). Consequently, practices for inventory monitoring, reorder thresholds, and demand forecasting differ significantly from ship to ship. This variability contributes to inconsistent levels of materiel readiness and exposes afloat units to the risk of stockouts if replenishment is not initiated with sufficient lead time.

Designated supply personnel within each medical department are responsible for maintaining system access to both R-SUPPLY (for MILSTRIP requisitions) and ECAT (for web-based procurements). Once a requisition is generated and approved through the unit's internal authorization process, the order is electronically transmitted to DLA Troop Support for sourcing, acquisition, and fulfillment (M. Jones, personal communication, April 9, 2025). This transaction marks the formal beginning of the external logistics process that results in the delivery of medical materiel to the afloat unit.

b. DLA Troop Support

DLA Troop Support serves as the global supply chain manager for medical materiel, equipment, and pharmaceuticals collectively categorized as Class VIII(a) in support of U.S. military operations worldwide. As the enterprise-level process owner, DLA Troop Support handles the acquisition, contracting, and sustainment of procurement vehicles, as well as the management of the electronic systems through which afloat units requisition medical materiel (Defense Logistics Agency, 2023).

Afloat units interact with DLA Troop Support primarily through two distinct ordering mechanisms:

- ECAT, a web-based procurement platform that facilitates streamlined ordering across pre-negotiated vendor contracts.
- MILSTRIP via R-SUPPLY, which enables ordering by National Stock Number (NSN).

Both systems electronically transmit orders from afloat units to DLA Troop Support for sourcing and fulfillment (R. Owens, PowerPoint slides, July 23, 2024).

While ECAT leverages automated e-commerce technologies to enable rapid order placement and processing, MILSTRIP remains a resource-intensive system requiring manual procurement actions and longer administrative lead times. As a result, MILSTRIP-based requisitions exhibit total landed costs per item that is higher than with ECAT transactions (T. Revak, personal communication, August 25, 2025).

(1) Ecommerce (ECAT)

The ECAT system provides afloat medical departments with a DLA-hosted, web-based procurement interface through which users can search, compare, and order Class VIII(a) items from multiple pre-approved vendors (M. Jones, personal communications, April 9, 2025). By utilizing existing DLA-negotiated contracts, ECAT facilitates cost-effective and expedited purchasing (T. Revak, personal communication, August 25, 2025).

Orders submitted via ECAT are received by DLA Troop Support in real time and are automatically acknowledged within the system. Once received, these orders are processed through an automated workflow that leverages existing long-term contracting vehicles to execute the purchase (Defense Logistics Agency Troop Support, PowerPoint slides, October 25, 2024). Vendor acceptance and order are automated and completed electronically. The entire transaction cycle is typically finalized within 36 hours of submission (T. Revak, personal communication, August 25, 2025).

If an ECAT order is not accepted by the vendor due to availability, contract status, or other constraints the requisition is automatically rerouted to the DLA depot ordering process and subsequently processed under the MILSTRIP acquisition pathway, which follows a typical procurement timeline.

(2) MILSTRIP Orders

Afloat units also procure Class VIII(a) materiel through the MILSTRIP process, which utilizes standardized NSNs corresponding to items in the ship's AMAL. Orders are initiated within R-SUPPLY, reviewed and approved through the ship's supply department, and electronically transmitted to DLA Troop Support for fulfillment.

Upon receipt, DLA servers aggregate and screen incoming MILSTRIP orders to identify requisitions eligible for automated conversion through the CAA sourcing, commonly referred to as the trap process (T. Revak, personal communication, August 25, 2025). This process, autonomously executed three times daily, analyzes MILSTRIP orders for compatibility with ECAT catalog listings. Orders meeting defined criteria are automatically converted into ECAT transactions, thereby reducing manual processing requirements and shortening lead times.

MILSTRIP orders that are not successfully converted to ecommerce orders via the trap process undergo further validation through DLA's Enterprise Business System (EBS) (Defense Logistics Agency Troop Support, PowerPoint slides, October 25, 2024). The EBS performs a "health check" of the NSN to ensure it is active, procurable, and associated with at least one available vendor.

- Validated (healthy) NSNs proceed to DLA depot ordering, a manual sourcing process characterized by significantly longer lead times.
- Unhealthy or obsolete NSNs are automatically cancelled, and the originating unit is notified.

Historically, ECAT-trapped items reach their initial delivery point within five days, whereas manually sourced MILSTRIP orders require approximately 60 days to arrive at the same stage (T. Revak, personal communication, August 25, 2025). This disparity underscores the operational importance of automated procurement pathways in maintaining afloat medical readiness and reducing supply chain latency.

c. Vendor

Commercial vendors play a pivotal role in sustaining the Class VIII(a) medical supply chain for U.S. Navy afloat units. DLA maintains only limited inventories of medical materiel, primarily items required for pandemic preparedness or other emergent contingency response operations. Consequently, most of the medical materiel necessary to maintain afloat medical readiness is sourced directly from contracted vendors. This vendor-based sourcing strategy reduces overall procurement and storage costs while mitigating the logistical burden associated with managing extensive inventories across a highly diverse catalog of medical materiel required by the Navy's varied ship classes (M. Jones, personal communication, April 9, 2025).

DLA executes procurements with vendors through two principal mechanisms: (1) long-term contracting vehicles, which integrate vendors into the ECAT system and facilitate recurring purchases through pre-established agreements, and (2) Direct Vendor Delivery (DVD) contracts, which are created and executed on an ad hoc basis for

MILSTRIP orders that cannot be converted to e-commerce transactions through the trap process.

In the case of ECAT orders, vendors receive automated electronic notifications from DLA Troop Support and are required to either confirm or deny the order electronically. If a vendor cannot fulfill an order due to stock unavailability, production delays, or other constraints the requisition is rejected and re-entered into the DLA Troop Support process flow for re-sourcing. Accepted ECAT orders are processed, packaged, and shipped directly from the vendor to the designated Continental United States (CONUS) shipping address. Contractual times typically stipulate fulfillment within 14 days for most consumable medical items, although many vendors complete order processing and shipment within one to three days of order receipt. Longer lead times are permitted for specialized or high-value medical equipment (R. Owens, PowerPoint slides, July 23, 2024).

For MILSTRIP-based procurements, DLA purchasing agents manually establish and execute one-time contracts with vendors to satisfy specific materiel requirements. Due to the individual nature of these contracts and the manual administrative workload involved both within DLA and at the vendor level, delivery lead times are longer. Consumable items sourced via MILSTRIP contracts may require up to 30 days for delivery, with extended times for specialized or hard-to-procure equipment. Once the contract is executed, the vendor prepares and ships the materiel to the assigned CONUS address for further transshipment (T. Revak, personal communication, August 25, 2025).

Vendors are compensated only after proof of delivery and receipt confirmation. Upon arrival and processing of the shipment at DDNV, electronic acknowledgment of receipt triggers payment authorization to the vendor through DLA's financial management system (M. Lassiter, personal communication, September 17, 2025). This performance-based payment structure incentivizes vendors to maintain efficiency, minimize delays, and ensure materiel integrity throughout the delivery process, while simultaneously safeguarding DLA from disbursing funds for undelivered or incomplete shipments.

d. Transshipment Center: DDNV

Because afloat units are inherently mobile and operate across multiple theaters, the Navy's medical logistics system requires a mechanism capable of receiving and forwarding medical materiel to ships regardless of their changing locations. It is neither practical nor secure for vendors to ship directly to vessels at sea or to continuously update shipping addresses to align with operational movements. Furthermore, the dynamic routing of cargo to deployed ships presents potential operational security risks. To mitigate these challenges, the DDNV facility serves as the only transshipment center for Class VIII(a) materiel supporting U.S. Navy afloat units.

This centralized transshipment model enhances efficiency and consistency across the supply chain. Vendors linked to DLA Troop Support contracts are pre-configured to ship afloat medical orders to DDNV, thereby reducing administrative variability and ensuring predictable routing (Keefe, 2025). Upon receipt at DDNV, all incoming shipments are logged, categorized, and staged for subsequent distribution to the appropriate afloat unit or forward delivery point.

(1) Materiel Receipt and Handling

DDNV receives inbound medical materiel Monday through Friday, excluding federal holidays. Upon arrival, packages are counted, logged, and segregated into handling categories that determine their storage and processing pathways. These categories include hazardous materials (HAZMAT), controlled substances, cold-chain items, and general medical supplies (further subdivided into local and non-local shipments).

Each pallet is labeled with its date of receipt and placed in an appropriate environmentally controlled storage area. DDNV maintains a Drug Enforcement Agency (DEA)-registered vault for controlled medications, accessible only by two authorized custodians (M. Lassiter, personal communication, September 17, 2025). Cold-chain items are stored in a temperature-monitored, walk-in refrigeration unit equipped with automated alarms to ensure compliance with temperature parameters. All other materiel types are staged in designated warehouse areas corresponding to their handling class.

Materiel remains in storage until assigned personnel initiate manual processing. Staff members process pallets according to FIFO sequencing, beginning with the oldest dated materiel. For cold-chain items, only package documentation is removed from cold storage for processing; the materiel remains under refrigeration until immediately prior to outbound shipment (Materiel Processors, personal communication, September 17, 2025).

Each order is processed in either the Warehouse Management System (WMS) or the Distribution Standard System (DSS). Processors use the contract number, requisition number, or item NSN to validate the order and confirm the receiving unit's eligibility for transshipment. They then reference the unit's CRIF to determine whether the shipment will be delivered locally or forwarded to a non-local destination (Materiel Processors, personal communication, September 17, 2025).

- Local deliveries are staged on a designated shelf by ship name and are later collected by ship personnel or delivered by DLA transport to the pier.

Figure 2. DDNV Pallet Sorted, Awaiting Processing for Local Units

Figure 3. DDNV Processed Materiel, Local Delivery Shelf with Materiel Awaiting Final Delivery or Pickup

- Non-local shipments are consolidated on outbound pallets, which are typically picked up the same afternoon by commercial carriers (e.g., FedEx, DHL, UPS, USPS). The system automatically assigns the most cost-effective and operationally appropriate carrier and mode of transport.

Figure 4. DDNV Sorted Pallet from 8/29/2025 Waiting to be Processed for Transshipment

Figure 5. DDNV Rows of Backlogged Materiel

Figure 6. DDNV Materiel Processing Workstation

(2) Staffing

The DDNV medical transshipment division operates with a staff of eleven personnel responsible for global afloat medical materiel processing. Materiel handlers perform rotational collateral duties such as forklift operations, receiving dock clerk functions, or cold-chain processing on a biweekly rotation. While these duties temporarily reduce individual processing capacity, personnel continue to contribute to throughput during their collateral assignments, ensuring continuity of operations. The supervisor and work lead both process materiel one quarter of their time on average (M. Lassiter, personal communication, September 17, 2025). Of the eight materiel processors after deducting the productivity loss due to collateral assignments, 6.5 full-time processors remain. The combined total processor production after deductions and including the processing productivity of the supervisor and lead equals seven full-time processors.

Table 1. DDNV Staff Composition

DDNV Staff Composition	Position Grade
1 Supervisor (processes 0.25 percent of time)	WS-6
1 Work Lead (processes 0.25 percent of time)	WL-6
1 Researcher	GS-6
8 Materiel processing handlers (deduct the workload of 1.5 processors due to collateral duty assignments)	WG-6 (7) WG-5 (1)
Note: -Two materiel handlers are HAZMAT certified -Two materiel handlers are controlled medicine custodians -All materiel processers are forklift certified	

(3) Cold-chain

Certain pharmaceuticals, biologics, and immunizations require strict temperature control throughout the supply chain. DDNV maintains detailed cold-chain handling protocols to preserve the integrity of temperature-sensitive items. Upon receipt, all such materiel is placed in a 24-hour temperature-monitored refrigeration unit, with alarms triggered for any deviation from prescribed parameters.

Outbound cold-chain shipments are scheduled to ensure arrival during standard working days when receiving units are manned to accept delivery. Packaging personnel review destination weather forecasts and select the appropriate insulated packaging protocol to maintain temperature stability during transit (Materiel Processor, personal communication, September 17, 2025). Each shipment includes a Temptale temperature-monitoring device, which records in-transit temperature data to verify compliance. DDNV maintains specialized packaging materials and refrigerants to support these operations and ensure medical materiel serviceability upon arrival.

Table 2. DDNV Cold-chain Shipping Schedule

Cold-chain Shipping Schedule From DDNV	
Monday	International, US
Tuesday	US
Wednesday	US
Thursday	Guam, Cuba
Friday	International

Source: Lassiter (2025).

(4) Controlled Substances

Controlled substances are governed by the Controlled Substances Act and DEA regulations. As a DEA-registered facility, DDNV is authorized to receive, store, and ship-controlled substances in compliance with federal law. Two trained materiel handlers serve as Controlled Substance Custodians, designated in writing by local command authority.

Upon receipt, all controlled medications are immediately transferred to the custodians, recorded in a controlled substance log, and secured in a locked vault. Processing occurs in batches once a minimum of six orders is queued. Controlled substances are double-packaged first within a sealed, tamper-evident inner container marked with identifying data, and then enclosed within a plain, unmarked outer package sealed with paper tape to maintain tamper-evidence integrity (Drug Enforcement Administration, 2022).

All controlled shipments are sent exclusively via United States Postal Service (USPS) Registered Mail, providing proof of delivery, signature verification, and chain-of-custody documentation (Drug Enforcement Administration, 2022). After mailing, custodians record tracking numbers in the controlled substance log. These records are auditable and retained to ensure compliance with DEA inspection and legal accountability requirements.

(5) HAZMAT

DDNV also manages medical materiel classified as hazardous, requiring specialized training and certification for processing and shipment. Two certified materiel handlers are authorized to package and ship HAZMAT in accordance with the International Air Transport Association (IATA) Dangerous Goods Regulations (M. Lassiter, personal communication, September 17, 2025).

To process a HAZMAT item, the handler enters the item's NSN into the DSS to retrieve regulatory handling data. Using the materiel's properties and weight, the handler references applicable Dangerous Goods Regulations to determine packaging, labeling, documentation, and transportation restrictions (Materiel processors, DDNV, personal communication, September 17, 2025). The item is then packaged in a properly rated container, labeled accordingly, and placed on the outbound pallet for collection by the designated commercial carrier.

(6) Materiel Processing Times

Materiel processing times vary by materiel type, general medical, controlled substance, HAZMAT, and cold-chain. The unique aspects of each take varying times to process in the data system, package, label, and ship. Processing seen in Table 3 ranges from 12 minutes to 30 minutes (Materiel processors, DDNV, personal communication, September 17, 2025). The difference is a result of materiel handling requirements, required research if materiel identifiers are missing, record keeping (specific to materiel type) data system manipulation, packaging, labeling, and shipping.

Table 3. Class VIII(a) Materiel Processing Times.

Materiel type	**Time to process on average (Minutes)**	**Production for one full time processor day (Orders)**
General Medical	12	40
HAZMAT	20	24
Cold Chain	30	16
Controlled Substances	30	16

Source: Materiel Processors (2025).

An average processor workday consists of 8 hours of production. One processor is always assigned to cold-chain items and one processor to HAZMAT. One processor ships-controlled substances one day per week, on average, (shipping general medical items on the other days) leaving the equivalent of four processors to process general medical items. The normal work week is Monday through Friday. During an average eight-hour workday production capacity if fully utilized ranges from 216–240 (216 if one processor shifts from general medical items to controlled substances) orders per day. When the backlog is greater than 1,000 orders, overtime is authorized at the discretion of management to increase production capacity. Workdays are extended to 12 hours, and an eight-hour weekend workday can be authorized (M. Lassiter, personal communication, September 17, 2025).

e. Commercial Transportation Carrier

For all non-local outbound shipments, DDNV relies on commercial transportation carriers to deliver Class VIII(a) medical materiel to designated destinations. The selection of carriers is managed automatically through DLA transportation management software, which optimizes routing based on cost-efficiency, delivery times, and compliance with regulatory shipping requirements. This automated carrier assignment ensures that each shipment meets the operational and fiscal objectives while minimizing administrative burden.

Commercial carriers routinely employed by DDNV include Federal Express (FedEx), United Parcel Service (UPS), DHL, and the United States Postal Service (USPS). The system evaluates shipment characteristics such as weight, packaging classification, and destination to determine the most effective mode of transport (Materiel processors, DDNV, personal communication, September 17, 2025).

Average delivery times for Class VIII(a) medical materiel shipped via commercial carrier are one to three days for Continental United States (CONUS) destinations and five to seven days plus up to four days to clear customs for Outside Continental United States (OCONUS) shipments, depending on carrier availability, routing distance, and customs or port clearance requirements (M. Lassiter, personal communication, September 17, 2025). The integration of commercial transportation providers within the DLA distribution network enables the Navy's medical logistics system to achieve rapid, reliable, and traceable delivery performance while maintaining cost discipline across global operations.

f. Last Mile Delivery

The last-mile delivery phase of the afloat medical logistics process is the final and often most dynamic segment of the Class VIII(a) supply chain. This stage is uniquely influenced by the operational status and underway schedule of the receiving unit, which determines how and when materiel can be physically delivered. Once outbound shipments are released from DDNV, the assigned commercial transportation carrier delivers the materiel to the address derived from the unit's CRIF, the authoritative source for routing and delivery instructions.

If the ship is in port, the DLA distribution facility at that location receives and processes the shipment and arranges pier-side delivery directly to the vessel which usually occurs in 1–4 days based on workload, manifesting availability, and commodity handling requirements (cold-chain is typically delivered within one day) (A. Delgado, personal communication, November 1, 2025). For units that are underway, several alternative delivery arrangements may be used. Afloat commands may elect to have their materiel held in port pending return to home station or next scheduled port visit. Alternatively, if the unit requires delivery while deployed, the cognizant operational fleet logistics authority coordinates the transfer of the materiel to a vessel assigned to conduct UNREP operations. The materiel is subsequently cross-decked from the replenishment ship to the receiving afloat unit. Ship schedule and employment heavily influence UNREP scheduling and availability.

This adaptive last-mile framework ensures that critical medical materiel can be delivered to ships regardless of location or operational posture, while maintaining the necessary security, accountability, and traceability of Class VIII(a) items throughout the final stage of the distribution process.

g. Afloat Unit Receipt

Upon delivery to the ship, whether through pier-side transfer while in port or via UNREP operations the ship's supply department assumes custody of the incoming Class VIII(a) medical materiel. The supply department is responsible for verifying, sorting, and distributing the items received to the appropriate departments aboard the vessel.

Once the medical department receives its designated materiel, personnel conduct an internal inspection to confirm completeness, serviceability, and accuracy against the original requisition documentation. Following verification, the materiel is entered into the ship's onboard logistics management system, updating inventory records and closing the supply action within the requisition system.

This final step marks the completion of the end-to-end afloat medical supply chain, linking the initial order placement at the unit level to final receipt and accountability aboard ship. Accurate and timely documentation at this stage ensures inventory integrity, audit readiness, and sustained medical materiel availability in support of operational readiness requirements.

2. Supply Chain Challenges

Challenges emerge at various points throughout the medical supply chain, affecting stakeholders at multiple organizational levels. These challenges can influence the performance of individual entities, disrupt specific processes within the chain, or create cascading effects that diminish the efficiency and reliability of the entire system. Understanding these stakeholder-specific constraints is essential for identifying root causes of inefficiency and developing targeted strategies to enhance overall supply chain performance.

a. Afloat Unit Ordering Challenges

The medical community within the U.S. Navy is predominantly shore-based, with most medical personnel serving the bulk of their careers in land-based medical treatment facilities. Consequently, most Sailors complete only one or two tours aboard afloat units, which limits their exposure to and familiarity with the unique demands of afloat medical logistics and Class VIII(a) materiel management (R. Connolly, personal communication, October 10, 2025).

This limited experience base results in significant variation in how medical logistics functions are executed at sea. Personnel assigned to afloat medical departments often lack formalized training or standardized procedures specific to afloat supply operations, leading to inconsistent ordering practices, uncertain inventory management, and inefficient use of procurement systems such as MILSTRIP and ECAT. The resulting knowledge gap directly affects the accuracy, timeliness, and reliability of order origination, thereby influencing the overall performance of the afloat medical supply chain.

b. DLA Troop Support Order Management and Disposition Challenges

The DLA Troop Support oversees an extensive portfolio of medical materiel procurement activities, processing approximately 200,000 Class VIII(a) requisitions annually through the MILSTRIP system (Defense Logistics Agency Troop Support, PowerPoint slides, October 25, 2024). Of these, an average of only 30 percent are successfully converted to e-commerce orders through the CAA trap process (Defense Logistics Agency Troop Support, PowerPoint slides, October 25, 2024). Two primary factors limit conversion efficiency in the trap process 1) insufficient NSN maintenance across the medical supply catalog and 2) the item has not been requested through a Product sourcing Request (PSR) to DLA Troop Support to be added to ECAT for an ecommerce solution.

NSN maintenance refers to the routine validation and updating of item records to ensure alignment with current commercial configurations and vendor catalog data. When a product undergoes changes such as adjustments in packaging quantity, manufacturer substitution, or modification to configuration its associated NSN may no longer accurately represent the item, rendering it invalid for procurement under that NSN. As a result, affected MILSTRIP orders cannot be converted into streamlined e-commerce transactions and must instead be processed manually through traditional contracting channels or be canceled.

AMAL reviews are conducted every 18–24 months by NMRLC assemblage managers with the support of fleet level stakeholders to evaluate entire assemblages with the goal of identifying any changes required for afloat assemblages due to NSN obsolescence, mission requirements, or changes to medical standards of care just to name a few (K. Schrecengost, personal communication, October 29, 2025). Currently NMRLC checks the health of the NSN but does not work with DLA Troop Support to validate availability of or request an ecommerce solution for AMAL items.

Enhancing the accuracy and currency of NSN data and incorporating PSR submission for afloat AMAL items without a validated ecommerce solution into AMAL reviews would significantly improve order conversion rates, reduce manual intervention, and decrease supply chain recovery costs associated with delayed fulfillment. Improved NSN and assemblage management would shorten end-to-end procurement duration, thereby enhancing responsiveness and reliability in the delivery of medical materiel to afloat units.

c. Transshipment Center Challenges

Interviews and on-site observations at DDNV identified several key challenges that impede the efficient transshipment of Class VIII(a) medical materiel. The most significant issue reported by process handlers is the absence of required documentation accompanying inbound shipments specifically, the requisition number, NSN, or contract number, which serves as the essential tracking method for materiel identification and routing (Materiel Processors, personal communication, September 17, 2025).

Without a requisition number, materiel handlers are unable to determine the ordering unit or validate the CRIF to determine intended delivery destination. Although DLA Troop Support contracts stipulate that vendors must include the requisition number on invoices and shipping documentation, this requirement is frequently unmet. When documentation is missing, DDNV personnel must conduct manual research across multiple data systems to locate the correct order record and associated requisition number. This additional research activity increases processing time by approximately 20% (Materiel Processors, personal communication, September 17, 2025).

When a requisition number cannot be located, handlers are required to complete a Supply Discrepancy Report (SDR) to formally notify DLA Troop Support. Completing and submitting this report adds an estimated two to three minutes of administrative time per incident. Between 15 May and 15 June 2025, DDNV submitted 262 SDRs for shipments received without proper documentation, illustrating the frequency and cumulative impact of this recurring issue (Materiel Processors, personal communication, September 17, 2025).

A secondary but increasingly critical challenge involves the growing backlog of unprocessed materiel awaiting transshipment. Management has established a backlog red-line threshold of 1,000 items, intended as the point at which additional resources or process adjustments are applied. Backlogs that exceed the threshold are managed by authorizing current staff to four additional hours on weekdays and 8 hours on the weekend. Despite the additional work from existing staff, the average daily backlog over the past 12 years has been approximately 1,491items, indicating persistent capacity shortfalls and over utilization. During the on-site observation period, the oldest pallet awaiting processing had been received 21 days prior, highlighting the operational implications of these delays.

Collectively, these challenges documentation deficiencies and persistent materiel backlogs significantly affect DDNV's throughput efficiency and the overall responsiveness of the afloat medical supply chain. Addressing these issues through enhanced vendor compliance, process automation, and resource alignment would substantially improve transshipment performance and reduce downstream delivery delays to fleet units.

3. Comparative Analysis of ECAT and MILSTRIP Ordering Mechanisms and Transshipment Times

A comparative review of the end-to-end timelines for ECAT and MILSTRIP procurement methods, combined with the observed variation between average and maximum transshipment processing times, revealed a total difference of 80.25 days between the most efficient and least efficient combinations of procurement and transshipment performance. This substantial disparity underscores the sensitivity of the performance of the Class VIII(a) supply chain to differences in both procurement pathways and transshipment throughput. To further assess the origins of this variance, the analysis focused on the two components of the supply chain that contributed the greatest proportion of total process time: procurement duration and transshipment processing time. These elements were examined in detail to quantify their respective impacts on overall supply chain responsiveness and to identify where targeted improvements may yield the greatest performance gains.

a. Procurement method impact on supply chain performance

End-to-end process models were constructed and compared to assess the total time required for Class VIII(a) medical materiel fulfillment between procurement pathways (Figures 8–10). This comparative framework enabled a systematic evaluation of the differential effects of the MILSTRIP and ECAT ordering mechanisms on overall supply chain performance. Using benchmark procurement timelines provided by the process owners, the analysis demonstrated that MILSTRIP procurement adds an average of 53.5 days relative to ECAT for both CONUS and OCONUS Class VIII(a) materiel. This substantial disparity highlights the central role of procurement methodology in shaping end-to-end logistics responsiveness.

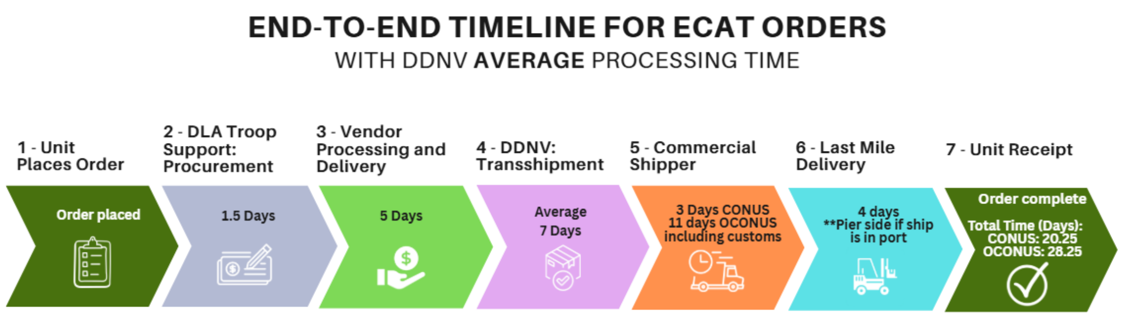

Figure 7. End-to-end Timeline for ECAT Orders with DDNV Average Processing Time, Sources: Revak (2025) and Lassiter (2025).

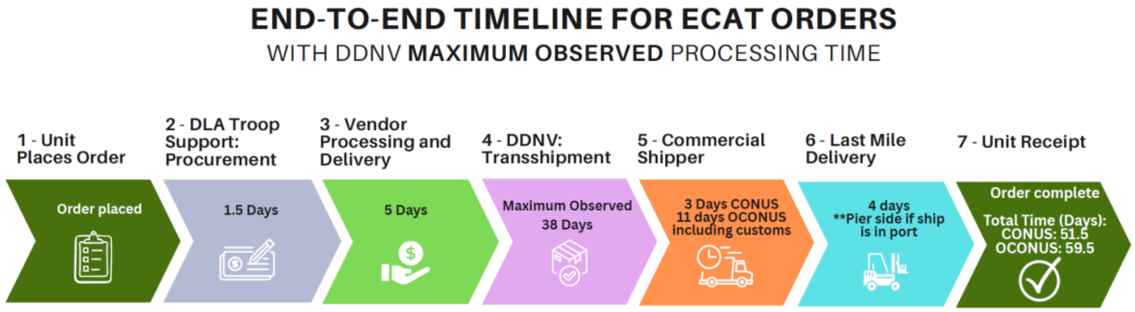

Figure 8. End-to-end Timeline for ECAT Orders with DDNV Maximum Observed Processing Time, Sources: Revak (2025) and Lassiter (2025).

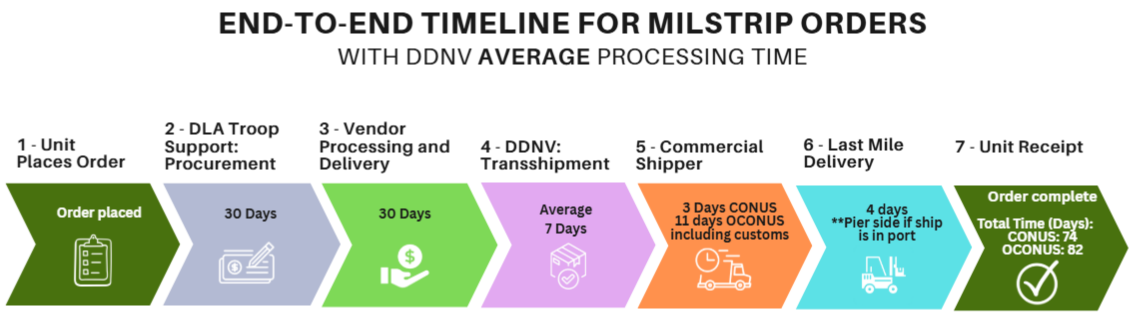

Figure 9. End-to-end Timeline for MILSTRIP Orders with DDNV Average Processing Time, Sources: Revak (2025) and Lassiter (2025).

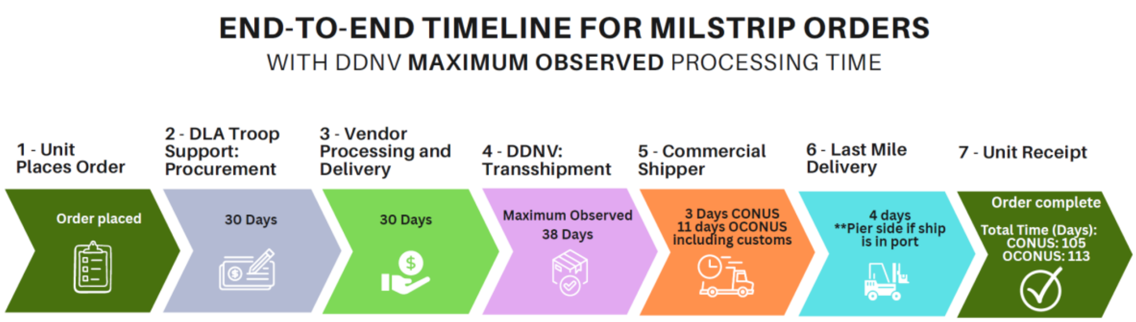

Figure 10. End-to-end Timeline for MILSTRIP Orders with DDNV Maximum Observed Processing Time, Sources: Revak (2025) and Lassiter (2025).

To evaluate the relative contribution of procurement method to the total end-to-end supply chain duration, the 53.5-day differential between ECAT and MILSTRIP was calculated as a percentage of the complete Class VIII(a) fulfillment duration. The results indicate that the time difference due to the difference in procurement pathway accounts for approximately 51% of total supply chain duration for CONUS units using the maximum transshipment time and 72% using the average transshipment time. The procurement differential accounted for 47% of total duration under average conditions and 65% under worst-case conditions . These ranges reflect the observed difference between average and maximum transshipment performance during the period from January 2023 through September 2025 (see Table 4). This analysis underscores the extent to which procurement methodology rather than transportation or transshipment factors shapes overall supply chain responsiveness.

Table 4. Procurement and Delivery Impacts on MILSTRIP Order Duration

MILSTRIP Procurement and Transshipment Processing Time	End-to-End Process Time in Days	Difference between MILSTRIP and ECAT Procurement and Associated Vendor Delivery in Days	Difference in procurement days as percentage of End-to-End time
Conus, With Average Transshipment time (11.5 days)	74	53.5	72%
OCONUS, With Average Transshipment time (11.5 days)	82	53.5	65%
CONUS, With Maximum Transshipment Time observed (38 days)	105	53.5	51%
OCONUS, With Maximum Transshipment Time observed (38 days)	113	53.5	47%

Data derived from analysis of end-to-end timelines with established performance times (Figures 7–10).

The analysis demonstrated that e-commerce-based procurement methods, particularly ECAT, provide substantial advantages in supply chain velocity and produce a marked reduction in end-to-end Class VIII(a) logistics latency. These efficiencies highlight the strategic importance of increasing the proportion of medical materiel procured through established e-commerce contracting mechanisms. To capitalize on these benefits, a deliberate and sustained effort is needed to align AMAL items with ECAT-supported contracts or to migrate items to e-commerce vehicles wherever feasible. Similarly, AMAL assemblage managers should prioritize the inclusion of products that are already available through existing ECAT contracts. Expanding e-commerce eligibility in this manner would increase the share of orders routed through automated procurement pathways, thereby shortening lead times, lowering total landed costs, and enhancing the overall responsiveness and resilience of the afloat medical supply chain.

b. Transshipment center performance impact on supply chain performance

The transshipment process is inherently labor-intensive, requiring extensive manual interaction with information systems, physical parcel handling, repackaging, labeling, and preparation for outbound shipment. To assess performance in this critical segment of the supply chain, daily production data from DDNV were analyzed for the period January 2023 through September 2025. Daily backlog volume and daily orders processed were used to calculate the number of days required to clear existing backlog, providing a direct measure of transshipment throughput and operational responsiveness. Over the evaluation period, the item backlog duration averaged 7 days, with a maximum of 38 days. Because DDNV operates under a first-in, first-out (FIFO) processing methodology and production performance fluctuates significantly day to day time on deck at DDNV can vary significantly making latency more unpredictable for the end user.

The analysis further demonstrated that the transshipment process is a major driver of end-to-end Class VIII(a) supply chain latency. Processing performance exhibited substantial variability; the coefficient of variation (CV) for days to process was 0.571, with a standard deviation of 6.42 days, indicating significant daily fluctuation in throughput. When incorporated into the total supply chain duration, transshipment accounted for 8.6% of total processing time under average conditions and up to 36% under maximum observed delay for longer-duration MILSTRIP orders. For shorter-duration ECAT orders, transshipment represented 34% of the total time under average conditions and up to 74%

under maximum delay (Table 5). These values reflect discrete operational scenarios—not statistical ranges or confidence intervals and illustrate how variability in transshipment performance directly shapes overall supply chain responsiveness, particularly when procurement times are compressed through e-commerce pathways.

Table 5. Transshipment Performance Compared to Total Supply Chain Performance

Unit Location, Procurement Method and Transshipment Processing Time	End-to-End Process Time in Days	Transshipment Performance in Days and Percent of Overall Supply Chain Time
CONUS, ECAT, Average Transshipment Time	20.5	7 / 34%
CONUS, ECAT, Maximum Observed Transshipment Time (38 days)	51.5	38 / 74%
CONUS, MILSTRIP, Average Transshipment Time	74	7 / 9.5%
CONUS, MILSTRIP, Maximum Observed Transshipment Time	105	38 / 36%
OCONUS, ECAT, Average Transshipment Time	28.5	7 / 24.5%
OCONUS, ECAT, Maximum Observed Transshipment Time	59.5	38 / 64%
OCONUS, MILSTRIP, Average Transshipment Time	82	7 / 8.6%
OCONUS, MILSTRIP, Maximum Observed Transshipment Time	113	38 / 34%

Sources: Revak (2025) and Lassiter (2025).

Transshipment represents the largest contributor to end-to-end supply chain duration for ECAT-procured Class VIII(a) items and the second largest contributor for MILSTRIP-based orders. As a result, transshipment performance exerts a disproportionate influence on overall supply chain times across both procurement pathways. Because the transshipment stage functions as the central processing and redistribution node for all afloat medical materiel, performance fluctuations at this point propagate throughout the entire logistics system. Accordingly, enhancing transshipment efficiency whether through increased processing capacity, reduced operational variability, or targeted process optimization would generate significant improvements in end-to-end supply chain responsiveness for both ECAT and MILSTRIP orders. Such improvements would directly strengthen afloat medical readiness by ensuring more predictable and timely delivery of critical Class VIII(a) materiel.

4. Transshipment Center Analysis

The transshipment function provided by DDNV is fundamental to the effectiveness of the Class VIII(a) medical supply chain. System-wide variability is heavily influenced by transshipment performance and utilization, as this node represents the central point through which all afloat medical materiel must pass. Current manpower levels and workflow processes are highly labor-intensive, contributing to sustained operational strain. Analysis of real-time production data from 1 January 2023 through 29 September 2025 revealed an average daily backlog of 1,486 orders awaiting processing. To manage this workload, DDNV routinely employed extended shifts, increasing weekday work hours from 8 to 12 hours and authorizing eight-hour weekend overtime shifts to maintain throughput. Although detailed manpower records were not available to calculate total overtime hours, management reported that 12-hour shifts were consistently required from January through June 2025 to sustain necessary processing rates. Since January 2023, overtime work occurred on 31 Saturdays (9 in 2023, 10 in 2024, and 12 in the first nine months of 2025), with an undetermined number of additional overtime days authorized.

For analytical purposes, transshipment performance was modeled over the 1,003 calendar days contained in the evaluation period, of which 694 were active production days. The model scaled daily throughput from the current capacity of 240 orders per day reflecting seven FTE processors to a maximum of 400 orders per day, representing an equivalent of 11 FTE processors. Each added processor FTE was assessed as one actual person with a production value of 40 orders per day. Collateral duty deductions and specialty materiel processing with lower throughput were already incorporated into the baseline manpower mapping and no additional deductions were necessary.

a. *Current single Transshipment Center Model Evaluation*

The model analysis revealed that the observed daily processing capacity of 240 orders at DDNV was significantly lower than the average daily receipt rate of 307.86 orders, resulting in a persistent backlog across the entire 1,003-day observation period. Of the 694 production days, demand required 95 percent or greater utilization on 685 days, representing 98.7 percent of all days in which processing occurred. Moreover, overtime or surge capacity was required on 538 production days (77.5 percent of the observed period) to keep backlog levels near the management-established redline threshold of 1,000 unprocessed orders. Collectively, these findings demonstrate a chronic mismatch between workload and available processing capacity under current staffing levels, leading to sustained operational strain and limited resilience to fluctuations in demand.

Increasing processing capacity has a direct and measurable effect on transshipment performance. Industry benchmarks for warehouse labor utilization typically fall between 75 and 85 percent, a range that allows for routine demand variation without major service disruptions, excessive queueing, or reliance on overtime for standard operations (Patrontasch, 2025). As shown in Table 6 and Figure 11, each additional full-time processor yields improvements across key performance indicators including utilization rate, average backlog days, average number of orders backlogged, and overtime requirements.

Modeling results indicate that having fourteen total staff (ten full-time equivalent processors) processors would produce substantial performance gains: average processing time decreases from 5.5 days to 1.7 days, representing a 69 percent reduction and more than a threefold improvement in throughput. At this staffing level, overtime requirements decrease by a factor of 28.3 (to 19), and average backlog volume falls below the 1,000-order threshold, achieving the desired operational state. Additionally, underutilization remains within acceptable limits, at less than 10 percent.

Increasing staffing from ten to eleven FTE processors provides only marginal benefits across processing metrics, while simultaneously increasing underutilization by

18.8 percentage points, to 28 percent, indicating diminishing returns beyond the ten-processor level.

The cost of increasing staffing is also quantifiable. A typical materiel processor at DDNV is classified as a Wage Grade 6 (WG-6) employee in the Norfolk wage area, earning \$24.04 – \$28.05 per hour, corresponding to an annual salary of \$50,003.20 – \$58,344.00 based on a standard 40-hour work week (Defense Civilian Personnel Advisory Service, 2024). Therefore, hiring three additional full-time processors to bring staffing levels to ten would require an estimated annual cost of \$150,009.60 to \$175,032.00, a figure that must be weighed against the substantial operational gains achieved through backlog reduction, overtime elimination, and improved supply chain responsiveness.

Table 6. Modeled Performance Impact of One Transshipment Center with Additional Processors

Total Staff	11	12	13	14	15
Processor FTEs	7	8	9	10	11
Daily Production Capacity	240	280	320	360	400
Days with Backlog	1003	1003	971	819	565
Average Backlog Orders	1454.3	1278.9	1033.3	663.2	334.8
Average Backlog Days	5.5	4.3	3	1.7	0.8
Max Backlog Orders	4064	3132	3091	2940	2547
Max Backlog Days	12.2	10.6	8.3	6.4	5.6
P80 Backlog Days	6.3	5.1	4.4	3.1	1.6
Number of Overtime Days Needed	538	232	67	19	2
Days at or Above 95% Utilization	685	588	366	151	51
Percentage of Production Days at or Above 95% Utilization	98.7%	84.7%	52.7%	21.8%	7.3%
Days at or Below 70% Utilization	0	0	9	64	194
Percentage of Production Days at or Below 70% Utilization	None	None	1.2%	9.2%	28%
Total Production Days	694	694	694	694	694

Period of observations for model evaluation was from 1 January 2023 to 29 September 2025, which accounts for 1003 calendar days and 694 production days. Actual demand numbers were used from real time DDNV data for that period.

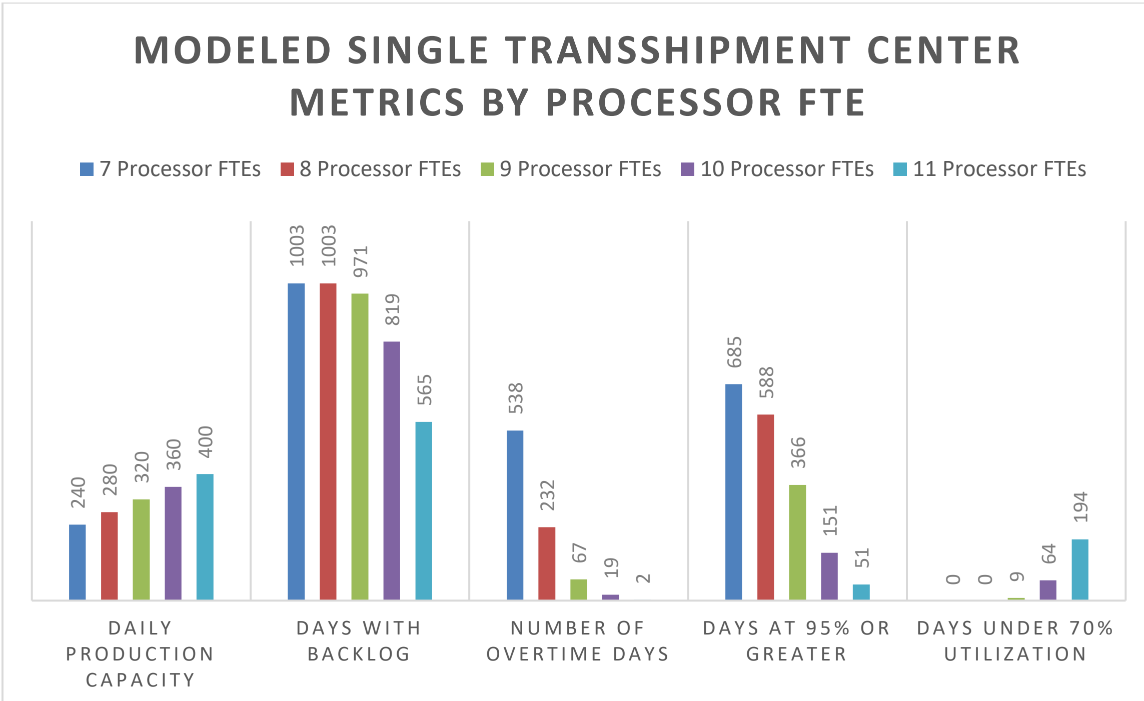

Figure 11. Modeled Single Transshipment Center Production Metrics

b. *Two Transshipment Node Model*

Two transshipment centers were modeled by dividing daily Class VIII(a) order receipts evenly between two facilities, each operating with the same manpower structure currently employed at DDNV. Modeling began with 11 total staff members, including 7 processor FTEs, and processor staffing was subsequently reduced to evaluate the balance between production capacity and workforce underutilization (Table 7). The analysis revealed that operating two transshipment centers with lower but highly variable daily receipt volumes presents a substantially more complex management challenge.

When each facility mirrors the current DDNV staffing structure (11 staff, 7 processor FTEs), the model predicts that 80 percent of orders are processed within one day; however, this configuration is highly inefficient, resulting in 59.1 percent underutilization well outside industry norms for effective warehouse labor management. Reducing staffing by one processor FTE significantly alters system behavior: overutilization increases from

1.2 percent to 22.1 percent, while underutilization decreases to 28.1 percent, indicating a more balanced yet still volatile operating state.

Further reducing staffing to 9 total personnel with 5 processor FTEs degrades system performance, increasing the average processing time to 3.4 days. Notably, this outcome is worse than the performance of a single transshipment center staffed with 14 personnel (10 processor FTEs), which achieved an average processing time of 1.7 days. These findings suggest that while distributing workload across two centers may improve geographic responsiveness by 1–2 days due to decreased commercial shipping times (gains which are offset by improved processing time at a single transshipment center), it also introduces substantial operational inefficiencies at a much higher cost.

Table 7. Modeled Performance Impact of Two Transshipment Centers

Total Staff per Facility	11	10	9	8
Processor FTEs	7	6	5	4
Daily Production Capacity	240	200	160	120
Days with Backlog	249	561	970	1003
Average Backlog Orders	62.6	157	543.2	117.4
Average Backlog Days	0.3	0.8	3.4	9
Max Backlog Orders	1093	1193.5	1545.5	2428
Max Backlog Days	3.9	6	9.7	17
P80 Backlog Days	0.2	1.6	5.2	10.2
Number of Overtime Days Needed	0	6	63	524
Days at or Above 95% Utilization	9	43	383	693
Percentage of Production Days at or Above 95% Utilization	1.2%	22.1%	55.2%	99.9%
Days at or Below 70% Utilization	410	195	10	0
Percentage of Production Days at or Below 70% Utilization	59.1%	28.1%	1.4%	None
Total Production Days	694	694	694	694

The modeling results indicate that a single transshipment center, augmented with three additional processors, outperforms a dual transshipment-center configuration (DDNV and a hypothetical West Coast site) across every evaluated production metric. Achieving 10 processor FTEs requires 14 total personnel in the single-center model, whereas the dual-center structure requires 18 total personnel to achieve the same combined processor capacity (see Table 8). The single-center configuration produces an average processing time of 1.7 days, which offsets the potential commercial shipping time savings associated with a West Coast facility, where modeled processing time increases to 3.4 days.

Average backlog levels further underscore the efficiency of the single-center approach. The single-center model maintains an average backlog of 663.2 orders, whereas the dual-center configuration generates an average backlog of 543.2 orders per site, or 1,086.6 orders combined a 39 percent increase in unprocessed materiel awaiting transshipment. Although the dual-center model appears to demonstrate improved performance on one metric days at or below 70 percent utilization (10 days per center compared to 64 days for the single center) this apparent advantage reflects excess capacity, not operational efficiency. When assessed in the context of manpower costs, the single-center configuration represents a more cost-effective posture.

Specifically, the annual manpower cost for the single transshipment center ranges from $716,404 to $841,995, while the dual-center model requires $951,194 to $1,122,517 (one center using Norfolk wage tables and the West Coast facility cost using San Diego and surrounding area wage tables), a difference of $234,790 to $280,522 annually (Defense Civilian Personnel Advisory Service, 2024; Defense Civilian Personnel Advisory Service, 2025; Office of Personnel Management, 2025). Thus, the single-center model provides 44 additional days of underutilization over a 33-month period, but at a substantially lower annual labor cost. These results indicate that the single transshipment center not only delivers superior processing performance but does so with materielly greater cost efficiency, making it the more advantageous configuration under current workload and staffing conditions.

Table 8. Comparison of Single Transshipment Center and Dual Transshipment Center Metrix Color Coded

	Single Transshipment Center	Two Transshipment centers	
	DDNV	East Coast	West Coast
Total Staff per Facility	14	9	9
Processor FTEs	10	5	5
Daily Production Capacity	360	160	160
Days with Backlog	819	970	970
Average Backlog Orders	663.2	543.2	543.2
Average Backlog Days/Days to Ship	1.7	3.4	3.4
Max Backlog Orders	2940	1545.5	1545.5
Max Backlog Days	6.4	9.7	9.7
P80 Backlog Days	3.1	5.2	5.2
Number of Overtime Days Needed	19	63	63
Days at or Above 95% Utilization	151	383	383
Percentage of Production Days at or Above 95% Utilization	21.8%	55.2%	55.2%
Days at or Below 70% Utilization	64	10	10
Percentage of Production Days at or Below 70% Utilization	9.2%	1.4%	1.4%
Total Production Days	694	694	694
Staff Cost	$716,404-841,995	$466,389-550,275	$484,805-572,242
Total Staff Cost	$716,404-841,995	$951,194-1,122,517	

B. FINDINGS AND RECOMMENDATIONS

The key findings highlight the central importance of procurement modernization, transshipment capacity optimization, and clear fleet-defined performance standards in improving Class VIII(a) medical materiel readiness for PACFLT afloat units:

- This study found that the Fleet has not established clear operational performance requirements for Class VIII(a) supply-chain responsiveness, leaving procurement system design, materiel positioning, and logistics planning without defined readiness benchmarks.
- Programmatic alignment of AMAL requirements with e-commerce contracting mechanisms particularly through ECAT represents a significant opportunity to increase supply chain velocity by reducing procurement lead times and leveraging automated ordering processes.
- Procurement method is the dominant driver of end-to-end latency, ECAT procurement was found to be 53.5 days faster on average than MILSTRIP. This difference accounted for 51–72% of total supply chain duration for CONUS units and 47–65% for OCONUS units. Ensuring that AMAL assemblages are aligned with e-commerce contracting mechanisms represents the single greatest opportunity to increase supply chain velocity.
- Transshipment Performance has a Disproportionate Impact on responsiveness, DDNV’s daily processing capacity (240 orders) was consistently outpaced by daily demand (307.86 orders), resulting in persistent backlog and high utilization levels. Backlog duration ranged from 7 days on average to 38 days at maximum. This variability accounted for up to 74% of the overall supply chain duration for ECAT orders.
- Increasing processing capacity at the existing transshipment center is high-yield and cost-effective, adding three processor FTEs reduced average processing time from 5.5 to 1.7 days, decreased overtime requirements dramatically, and lowered backlog below the 1,000-order threshold. These

improvements would be achieved at significantly lower cost than establishing new transshipment infrastructure.

- Establishing a second transshipment center would be less efficient and more costly, the dual-center model (DDNV plus a hypothetical West Coast site) required 18 personnel to achieve 10 processor FTEs compared to 14 personnel in the single-center model while producing higher total backlog (39% more materiel awaiting processing), longer processing times, and significantly higher annual manpower costs. Under current operational conditions, a second transshipment center does not improve system responsiveness.
- Fleet-defined performance requirements are needed to guide system optimization, the Navy has not formally established supply chain responsiveness standards for Class VIII(a) materiel. Absent such benchmarks, it is difficult for stakeholders to align procurement pathways, capacity investments, and logistics processes with operational medical support requirements.
- Expanding processing capacity at the existing transshipment center would yield substantial improvements, reducing backlog, increasing throughput, and improving utilization metrics, directly enhancing end-to-end supply chain performance.
- Establishing a second transshipment center would incur considerably higher manpower costs and it would not improve system responsiveness at equivalent total processor FTE levels; in fact, the single-center model consistently outperformed the dual-center configuration across all major production metrics.

Based on the findings of this study, several actionable recommendations are proposed to improve the responsiveness, efficiency, and reliability of the U.S. Navy's Class VIII(a) medical supply chain in support of PACFLT afloat units. These recommendations target key leverage points identified through end-to-end process mapping, procurement analysis, and transshipment performance modeling.

1. Establish Fleet-Level Performance Requirements for Class VIII(a) Supply Chain Responsiveness

A structured set of performance standards should be developed and promulgated by PACFLT or the appropriate fleet level representatives to define expected duration for procurement, transshipment, transportation, and last-mile delivery. Clear requirements such as acceptable order-to-receipt times for ECAT and MILSTRIP orders, maximum allowable backlog thresholds, and transshipment processing standards would provide the framework necessary to align system performance with operational medical readiness needs. Without explicit fleet-driven requirements, stakeholders cannot effectively prioritize improvements or evaluate supply chain performance relative to mission demands.

2. Align AMAL Assemblage Requirements with Ecommerce Contracting Mechanisms

Incorporating systematic programmatic review and alignment of AMAL assemblages with items available through ECAT and other e-commerce contracting vehicles would substantially reduce procurement lead times. In cases where essential AMAL items are not currently supported by e-commerce contracts, units and assemblage managers should initiate product sourcing requests through DLA Troop Support to add these items to existing ECAT contract lines whenever clinically and logistically feasible. The analysis demonstrated that ECAT procurement is, on average, 53.5 days faster than MILSTRIP, underscoring the operational benefit of maximizing e-commerce eligibility. Ensuring that AMAL requirements are sourced from vendors with active e-commerce contracts or adjusting assemblage compositions to incorporate such items where appropriate would increase the proportion of Class VIII(a) materiel processed through automated procurement pathways and materielly enhance supply chain velocity.

3. Increase Processing Capacity at the Existing Transshipment Center (DDNV)

The modeling results clearly indicate that increasing processing capacity at DDNV offers substantial performance gains. Adding three additional processor FTEs (for a total of ten processors) reduces average processing time from 5.5 days to 1.7 days, decreases overtime by a factor of 28.3, and lowers backlog below the 1,000-order threshold. This improvement is achieved at a significantly lower cost than establishing new infrastructure or additional facilities. Investment in targeted manpower increases supported by potential workload-sharing or surge staffing mechanisms represents the most efficient and cost-effective approach to improving system performance.

4. Forego Establishing a Second Transshipment Center Under Current Conditions

Although geographically distributed transshipment infrastructure may appear beneficial, the model demonstrated that dual transshipment centers:

- Require 18 staff to match the processing capacity achievable with 14 staff at a single center.
- Generate a 39% increase in total backlog.
- Yield slower average processing times (3.4 days vs. 1.7 days).
- Increase annual manpower costs by $234,790 $280,522.

Given these outcomes, establishing a second transshipment center specifically a West Coast facility is not supported by the data under present workload and staffing conditions. Resources are better directed toward optimizing the existing transshipment center. This recommendation should be revisited if there is a reason or condition where process redundancy becomes important or where commercial shipment of goods from a transshipment center is no longer viable (i.e., a conflict that impacts ability to use commercial shippers).

V. CONCLUSION

For afloat units operating across the vast and dynamic Indo-Pacific region, medical readiness depends on the Navy's ability to source, process, and deliver medical materiel rapidly and reliably. Delays in Class VIII(a) fulfillment place additional strain on shipboard medical departments, reduce operational flexibility, and elevate risk to force health protection during contingency or high-tempo operations. To better understand the sources of these delays, this study developed a comprehensive end-to-end process flow map detailing every stage of Class VIII(a) movement—from order initiation through procurement, transshipment, transportation, and final receipt—across both ECAT and MILSTRIP pathways. This mapping provided critical visibility into key interactions, decision points, and organizational seams that shape supply-chain performance, enabling a systematic assessment of where delays originate and how they propagate through the system.

By integrating process mapping with qualitative insights from fleet stakeholders and quantitative analysis of procurement and transshipment performance, the study identified procurement method selection, transshipment processing capacity, and workload variability as primary drivers of latency. The findings demonstrate that aligning AMAL requirements with e-commerce contracting mechanisms, increasing processing capacity at the transshipment center, and establishing clear fleet performance standards would substantially improve supply-chain velocity and strengthen afloat medical readiness. Collectively, this research provides a data-driven foundation for modernizing the Navy's medical logistics enterprise and enhancing the ability of PACFLT units to sustain operations in a contested and rapidly evolving theater.

This study is subject to several limitations. First, DDNV performance data were drawn from a 33-month period (January 2023 September 2025) to avoid COVID ordering irregularities and reflect current staffing utilization, longer-term historical analyses were limited by changes in workforce composition and internal processes. Second, interview-based insights, while valuable, represent the perspectives of stakeholders available during the study period and may not capture system-wide variation. Third, the modeling assumes consistent daily order arrival patterns and equal distribution of orders in the dual-center scenario, which may differ under real operational conditions. Despite these limitations, the combination of qualitative and quantitative evidence provides a robust foundation for the study's conclusions and recommendations.

Further study is warranted in several areas. The Navy would benefit from an evaluation of the feasibility and effectiveness of predictive supply models for Class VIII(a) usage during DMO. Additionally, research into information system automation, including enhanced requisition data integrity and integrated vendor documentation standards, could yield significant performance improvements. Finally, an assessment of surge staffing models, reserve logistics augmentation, or contractor support during contingency operations could strengthen supply chain resilience in conflict scenarios.

This research demonstrates that improving afloat medical readiness requires targeted investments in procurement modernization, transshipment capacity, and system-wide performance standards. The findings reinforce that a single, well-resourced transshipment center combined with greater reliance on e-commerce procurement pathways offers the most effective and cost-efficient means of reducing Class VIII(a) lead times for PACFLT. By implementing the recommendations outlined in this study, the Navy can significantly enhance the responsiveness, agility, and resilience of its medical supply chain ensuring that afloat forces remain prepared to meet the operational and medical demands of modern maritime conflict.

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